

TRANSMISSION MECHANISM FOR DRIVING FOUR WHEELS

Priority is claimed to Chinese application number 02253907.7, filed September 12, 2002, which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

5 1. Field of the Invention

[0001] The present invention relates to a transmission mechanism of automotive vehicles, and more particularly to a transmission mechanism for driving four wheels.

2. Description of the Related Art

[0002] Many transmission mechanisms with a differential gear lock limiting mechanism have 10 been used in some automotive vehicles. Because when an automotive vehicle encounters weaker roads, such as loose soil, foothill and the like, two wheels of the automotive vehicle at the same side may lose adhesions to the ground to cause skidding. The differential gear lock limiting mechanism can limit different rotating speeds of the two wheels up to locking the differential gear of the automotive vehicle. In this case, the driving side shafts of the two sides will be 15 integral, and the automotive vehicle can only be driven in line. Moreover, the differential gear lock limiting mechanism used in the art is complicated, expensive and difficult to maintain.

[0003] Hence, a transmission mechanism that overcomes the above-mentioned problems is desired.

SUMMARY OF THE INVENTION

20 **[0004]** Accordingly, an object of the present invention is to provide a transmission mechanism for driving four wheels of an automotive vehicle that overcomes the shortcomings in the prior art.

[0005] In order to achieve the above-mentioned object, a transmission mechanism for driving 25 four wheels of an automotive vehicle in accordance with the present invention comprises a drive housing; a differential mechanism including a right side bevel gear, a left side bevel gear and a

ring gear; a driving power input shaft mounted to the left upper portion of the drive housing; a first dual tandem gear mounted on the driving power input shaft; a second dual tandem gear mounted on the driving power input shaft; a propeller shaft mounted to the left middle portion of the drive housing; a sixth gear fixed to the propeller shaft; a fourth gear mounted on the propeller shaft; a fifth gear mounted on the propeller shaft; a third dual tandem gear mounted on the propeller shaft; a core shaft mounted to the left lower portion of the drive housing, on which the differential mechanism is mounted; a eighth gear connected with the core shaft; a seventh gear connected with the core shaft; a front right wheel output shaft engaged with the core shaft via a engaging member; a front left wheel output shaft engaged with the core shaft via a slidable engaging member; a rear left wheel output shaft mounted to the right lower portion of the driving housing; a ninth gear fixed to the rear left wheel output shaft; and when the driving power input shaft is driven, the second dual tandem gear can be regulated to mesh with either the third dual tandem gear or the first dual tandem gear, so that the differential mechanism can obtain different speeds, and wheels at the same side of the automotive vehicle can be driven at the same time.

15 [0006] In one embedment of the present invention, the front right wheel output shaft is mounted within the front left wheel output shaft, and the front left wheel output shaft is engaged the seven gear with a slidable engaging member.

20 [0007] In another embodiment of the invention, the first dual tandem gear includes a first larger gear and an inner gear at a side surface of the larger gear to mesh with a second smaller gear of the second dual tandem gear.

[0008] In a further embodiment of the invention, each of the second dual tandem gear and the slidable engaging member provides a recess at the outer surface thereof for connecting a fork.

25 [0009] In the invention, he third dual tandem gear may include a third larger gear and a third smaller gear to mesh with a larger gear of the second dual tandem gear and the first larger gear, respectively, and the second dual tandem gear may be splined to the driving power input shaft.

[0010] The transmission mechanism of the present invention makes use of a differential mechanism to drive four wheels instead of two differential mechanisms in the prior art disposed on the front axle and rear axle. Therefore, the transmission mechanism is of a compact structure, which increases the clearance between the chassis of the automotive vehicle and the ground.

5 Furthermore, the differential mechanism used makes speeds between the left side wheels and the right side wheels different. Thus, the performance of the automotive vehicle is improved and the automotive vehicle can be steered smoothly.

[0011] Other objects, features and advantages of the present invention will become apparent from the following detailed description when read in conjunction with the accompanying

10 drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. 1 is a schematic plan view of a transmission mechanism in accordance with the present invention;

[0013] FIG. 2 is a schematic and sketching side view showing the location of shafts of the transmission mechanism as shown in FIG. 1; and

[0014] FIG. 3 is a schematically explored view of a transmission mechanism in accordance with the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

[0015] The present invention will be further described below with reference to the drawings.

20 [0016] Referring to FIGs. 1 to 3, a transmission mechanism 100 of an automotive vehicle for driving four wheels in accordance with the present invention comprises a drive housing 24, a driving power input shaft 1, a propeller shaft 20, a core shaft 15, a rear left wheel output shaft 18, a front left wheel output shaft 9, a front right wheel output shaft 10, and a differential mechanism 13 disposed at the lower portion of the drive housing 24 and including a right side bevel gear 14, a left

25 side bevel gear 12 and a ring gear 11.

[0017] The driving power input shaft 1 is connected with an engine (not shown) of the automotive vehicle (not shown) and disposed at the left upper portion of the driving housing 24. A first dual tandem gear 2 having a first larger gear 203 and a first smaller gear 201 is mounted on the input shaft 1 via three roller bearings 207, 209 and 211, and provides an inner gear 205 extended inward from a side surface of the first larger gear 203. A second dual tandem gear 3 having a second larger gear 303 and a second smaller gear 301 is splined to the input shaft 1 via a first spline 307, and the second smaller gear 301 can mesh with the inner gear 205 of the first dual tandem gear 2.

[0018] The propeller shaft 20 is disposed at the left middle portion of the driving housing 24. 10 A sixth gear 6 is splined to the propeller shaft 20 via a second spline 607, a fourth gear 4 and a fifth gear 5 are mounted on the propeller shaft 20 via a third spline 407 and a roller bearing 507, respectively. A third dual tandem gear 16 including a third larger gear 163 and a third smaller gear 161 to respectively mesh with the second larger gear 303 of the second dual tandem gear 3 and the first larger gear 203 of the first dual tandem gear 2 is mounted on the propeller shaft 20 via 15 a roller bearing 167.

[0019] Elements of the differential mechanism 13 used in this invention are the same as those in the prior art except those specifically described herein. The core shaft 15 is disposed at the left lower portion of the driving housing 24. The right side bevel gear 14 and the left side bevel gear 12 are mounted on the core shaft 15. An eighth gear 17 meshing with the fourth gear 4 is splined 20 to a first shaft sleeve 142 of the right side bevel gear 14 via a fourth spline 177. The ring gear 11 meshing with the fifth gear 5 is fixed on a second shaft sleeve 132 of a differential case 130 of the differential mechanism 13. A seventh gear 7 meshing with the sixth gear 6 is mounted on the core shaft 15 via a roller bearings 77.

[0020] The front right wheel output shaft 10 is coaxially connected with the core shaft 15 via 25 an engaging member 21. The front right wheel output shaft 10 is mounted within, and is connected to via a slidable engaging member 8, the front left wheel output shaft 9.

[0021] The rear left wheel output shaft 18 is connected with a rear left wheel (not shown) of the automotive vehicle and disposed at the right lower portion of the driving housing 24. A ninth gear 19 is splined to the rear left wheel output shaft 18 via a fifth spline 197 to mesh with the eighth gear 17.

5 **[0022]** Recesses 305 and 802 are provided at the outer surface of the second dual tandem gear 3 and the slidable engaging member 8, respectively, to accommodate forks (not shown) which extend out of the drive housing 24.

10 **[0023]** The operation of the transmission mechanism 100 of the present invention for driving four wheels will now be described as follows. The driving power is transmitted to the driving power input shaft 1, which drives the second dual tandem gear 3 to rotate around the input shaft 1. The second dual tandem gear 3 can be regulated to mesh with either the third larger gear 163 of the third dual tandem gear 16 with the larger gear 303 or the first dual tandem gear 2 with the second smaller gear 301.

15 **[0024]** Then, the driving power through the first smaller gear 201 is transmitted to the ring gear 11 of the differential mechanism 13 and drives it to rotate together with the right side bevel gear 14 and the left side bevel gear 12. The driving power through the differential mechanism 13 is divided into two parts. The part of the driving power through the right side bevel gear 14 is further divided into two subparts. One subpart can be transmitted to, and then drive, the rear left wheel output shaft 18 via the eighth gear 17 and the ninth gear 19. Another subpart can be 20 transmitted to the propeller shaft 20 via the eighth gear 17 and the fourth gear 4, and then transmitted to the slidable engaging member 8 via the sixth gear 6 and the seventh gear 7, at last transmitted to the front left wheel output shaft 9.

25 **[0025]** Another part of the driving power through the left side bevel gear 12 is transmitted to the core shaft 15 via the corresponding splines and is further divided into two subparts. A subpart is transmitted to a rear right wheel (not shown) directly connected to the core shaft 15. Another subpart is transmitted to the front right output wheel 10 via the engaging member 21. As a result,

the two front output shafts 9, 10 are driven by the slidable engaging members 8 matching with the engaging member 21, and the two rear output shafts are driven in parallel. With the transmission mechanism 100 of the present invention, the wheels at the same side can be driven at the same time.

5 [0026] When an automotive vehicle equipped the transmission mechanism of the invention moves on weaker roads, even though a wheel skids and loses the adhesion to the ground, the output power of the engine will not decrease because the skidding wheel doesn't rotate. Meanwhile, another unskidding wheel at the same side can still be driven because the two wheels are controlled by the same side bevel gear. Because other two wheels at another side are
10 controlled by another side bevel gear, the vehicle can run normally. As a result, when two wheels at the same side skid, the vehicle can move via the other two unskidding wheels at the same side, and when two wheels at the different sides skid, the automotive vehicle can move via the other two unskidding wheels at the different sides.

[0027] It is understood that the particular structures embodying the present invention shown
15 and described above are only used for illustrating the present invention, and are not intended to limit the invention. Any modifications or variations to the present invention without departing from the spirit of the invention shall be fallen into the scope of the invention defined by the appended claims.